PHYSICS

Nuclear Physics Advances

The past year has seen great progress in nuclear physics in areas ranging from theory to more accurate measurement of the lifetime of a free neutrino.

By ANN EWING
From Geneva

➤ "GREAT PROGRESS" in nuclear physics has been made during the past year, Dr. J. Robert Oppenheimer, director of the Institute for Advanced Study, Princeton, N. J., told SCIENCE SERVICE.

This progress is an understanding of the so-called weak interactions of nuclear particles, which gives scientists a new tool to use as a probe for strong reactions. The new understanding is on a firm foundation both theoretically and experimentally, Dr. Oppenheimer reported.

The famous physicist attended the 1958 International Conference on High Energy Physics held in Geneva at CERN, the European Organization for Nuclear Research operated jointly by 12 nations.

The universal theory of weak interactions concerns the strange world within the atomic nucleus. It was first proposed by Drs. Robert Marshak and E. C. G. Sudarshan of the University of Rochester, N. Y., and, independently, by Drs. Richard P. Feynman and M. Gell-Mann of California Institute of Technology, Pasadena.

Experimental evidence confirming the theory was presented to the Conference by Dr. M. Goldhaber of Brookhaven National Laboratory, Upton, N. Y., who reported his studies and those of others.

One example of a weak interaction in nuclear physics is known as "beta decay," the emission of an electron by a radioactive element. The downfall of the once dearly held theory that parity (the equivalence of an object or system with its mirror image) is conserved resulted from studies of weak interactions. Suggesting that parity is not always conserved won the 1957 Nobel Prize in Physics for two others who attended the Conference, Drs. T. D. Lee and C. N. Yang, also of the Institute.

Further experiments have confirmed that parity is not conserved, Dr. Goldhaber reported. He said, however, that no experiments have yet shown any evidence that time reversal is possible.

One unsolved problem, Dr. Oppenheimer said, is the electric structure of neutrons and protons, fundamental particles of an atomic nucleus. He said he was hopeful this and other problems would yield to solution through use of the new "dispersion relations," which are made possible because weak interactions are now understood.

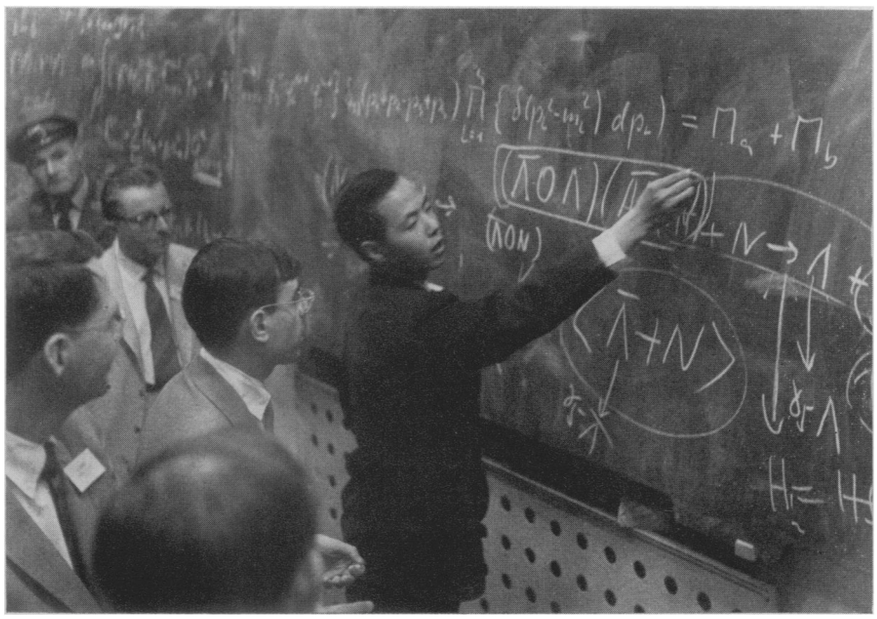
Neutron's Lifetime

➤ THE RUSSIANS have determined the lifetime of a free neutron more accurately than any previous studies. It is 11.7 minutes with an accuracy of three-tenths of a minute more or less than 11.7.

The new, accurate determination was reported to the meeting by Dr. M. Goldhaber of Brookhaven National Laboratory, Upton, N. Y. Neutrons are fundamental nuclear particles, essential to the production of the fission reactions that give the atomic bomb its "bang" or yield power under controlled conditions.

Dr. Goldhaber also reported that the cross section, or area in which a reaction occurs, for the neutrino has been measured. It is the unbelievably tiny area of the figure one preceded by 42 zeroes of a square centimeter. Or one times ten to the minus 43rd power for the science-minded.

The neutrino is a ghost particle, having virtually zero mass and no electric charge. Its spin is in the right-handed direction, while that of the anti-neutrino is left-handed, Dr. Goldhaber reported.



PHYSICS ACROSS THE BOARD—Dr. T. D. Lee is at the blackboard at the international meeting in Geneva.

Heisenberg's Theory

➤ PROF. WERNER Heisenberg's proposed basic equation of matter was strongly criticized by fellow scientists.

The theory was termed "mathematically objectionable" by Prof. Wolfgang Pauli of the University of Zurich, who was associated with Prof. Heisenberg in early stages of formulating the proposed equations but who later withdrew his cooperation.

Prof. Heisenberg of the Max Planck Institute, Gottingen, Germany, has attempted to unify in one theory the strong forces binding together the particles within atomic nuclei and the gravitational forces that govern the motions of planets.

His attempt is unsuccessful, most scientists attending the Conference agreed, after hearing Prof. Heisenberg explain the theory. The proposed equations have been discussed privately by scientists since last February but details were not revealed until this meeting.

A unified field theory, in which electromagnetic and gravitational forces are linked together using only simple, fundamental assumptions was the life-long goal of the late Prof. Albert Einstein. His unified field theory contains mathematics so extremely difficult that scientists expect it will be many years before the theory can be proved or disproved.

Therefore, in describing atomic particles, scientists use the quantum theory. They use another, seemingly unrelated set of equations to describe gravitation.

Prof. Heisenberg said he would continue working on his equations, but other scientists doubted that this would be profitable because of the unsound mathematical assumptions in the theory.

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TECHNOLOGY

"Washing" Method Saves Radioactive Equipment

➤ TECHNICIANS at the General Electric Hanford atomic plant near Richland, Wash., have saved $90,000 in six months by "washing" equipment formerly discarded as too "hot" to handle. Expensive pumps, centrifuges, etc., that workmen could not approach to repair, are now immersed in boiling chemicals and a 28-foot-deep pool of water, reducing radioactive contamination to safe levels.

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